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LITEMAX
Sunlight Readable LCD!

ENRICH YOUR VISUAL WORLD...

DURApixel by LITEMAX Wide Temp LED Backlight

RoHS·WEEE LITEMAX COMPLIANT

# LITEMAX DLF/DLH1555

## Sunlight readable 15” LED B/L LCD

(2st Edition 8/14/2007 )
All information is subject to change without notice.

| Approved by | Checked by | Prepared by |
|---|---|---|
| David | Sharline | River,Eric |

**LITEMAX Electronics Inc.**
8F, No.137, Lane 235, Bau-chiau Rd.,
Shin-dian City, Taipei County, Taiwan R.O.C.
Tel : 886-2-8919-1858
Fax: 886-2-8919-1300
Homepage: http://www.litemax.com.tw



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## Record of Revision

| Version and Date | Page | Old Description | New Description | Remark |
|---|---|---|---|---|
| 8/14/07" v.01 | | | First Release | |
| 8/11/08" v2.1 | 7 | LED Voltage 17V | LED Voltage 17.15V | Revision |
| | | LED Current 1350mA | LED Current 872mA | |
| | 9 | Power Consumption 24.3W | Power Consumption 14.95W | |
| | 11 | Backlight Connector Part: TBD | Connector Part: HD2505-02 or equivalent | Add |
| | | | Matching Connector Part No.:TD2505-02or equivalent | |
| | 15 | TEST CONDITIONS | | Revision |
| | | LED Current 1350mA<br>LED Driver Board : Litemax LID15A01 | LED Current 872mA<br>LED Driver Board : Litemax LID15A02 | |
| | | OPTICAL SPECIFICATIONS | | |
| | | Color chromaticity :<br>Rx=0.613<br>Ry=0.334<br>Gx=0.302<br>Gy=0.567<br>Bx=0.144<br>By=0.102<br>Wx=0.313<br>Wy=0.329 | Rx=0.603<br>Ry=0.371<br>Gx=0.375<br>Gy=0.541<br>Bx=0.165<br>By=0.084<br>Wx=0.341<br>Wy=0.329 | |
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## Contents



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# GENERAL DESCRIPTION

## OVERVIEW

CM1555E is a 15.0” TFT Liquid Crystal Display module with LED Backlight units and 20 pins LVDS interface. This module supports 1024 x 768 XGA mode and can display 16.2M colors. The PSWG is to establish a set of displays with standard mechanical dimensions and select electrical interface requirements for an industry standard 15.0” XGA LCD panel and the inverter module for Backlight is not built in.

## FEATURES

- LED B/L
- 1000 nits
- Wide dimming range
- XGA (1024 x 768 pixels) resolution
- DE(data enable) only mode
- LVDS interface with 1pixel/clock
- PSWG (panel standardization working group)
- Wide operating temperature.
- RoHs compliance

## APPLICATION

- TFT LCD monitor
- Factory application
- Amusement
- Transportation

## GENERAL SPECIFICATI0NS

| Item | Specification | Unit | Note |
|---|---|---|---|
| Active Area | 304.128 (H) x 228.096(V) (15.0”LED Backlight) | mm | (1) |
| Bezel Opening Area | 307.4(H) x 231.3(V) | mm | |
| Driver Element | a-Si TFT active matrix | - | - |
| Pixel Number | 1024 x R.G.B x 768 | pixel | - |
| Pixel Pitch | 0.297(H) x 0.297(W) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 16.2M color | color | - |
| Display Mode | Normally white | - | - |
| Surface Treatment | Hard Coating (3H), Anti-Glare ( Haze 25) | - | - |

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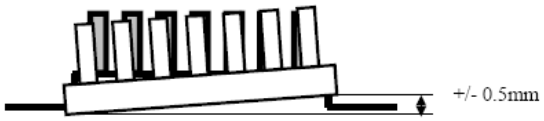
## MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal(H) | 326.0 | 326.5 | 327.0 | mm | (1) |
| | Vertical(V) | 253.0 | 253.5 | 254.0 | mm | |
| | Depth(D) | - | - | 14.5 | mm | (1)(2) |
| Weight | | - | - | 1200 | g | - |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions. Note

(2) The depth is without connector.

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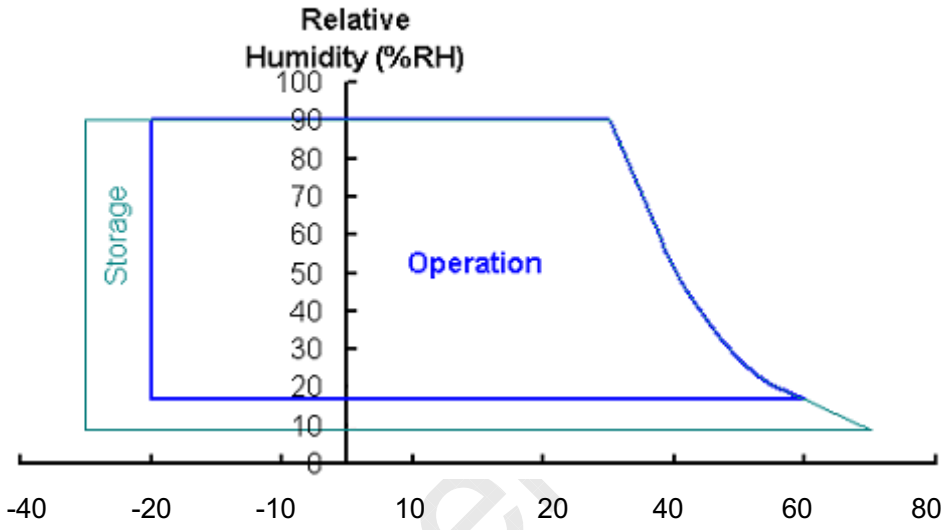
## ABSOLUTE MAXIMUM RATINGS

### ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Storage Temperature | TST | -40 | 80 | ºC | (1) |
| Operating Ambient Temperature | TOP | -20 | 60 | ºC | (1), (2), (6) |
| Shock (Non-Operating) | SNOP | - | 50G | G | (3), (5) |
| Vibration (Non-Operating) | VNOP | - | 1.5 | G | (4), (5) |




Note (1) Temperature and relative humidity range is shown in the figure below.
(a) 90 %RH Max. (Ta ≤ 40 ºC).
(b) No condensation of water.
Note (2) The temperature of panel surface should be -20ºC Min. and 60 ºC Max.
Note (3) 11ms, 1 time each ±X,±Y and ±Z directions
Note (4) 10 ~ 500 Hz sine wave, 30 min./1 cycle , 1.5mm max, 30 min. each X, Y and Z directions
Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough
so that the module would not be twisted or bent by the fixture.
Note (6) Panel at -20ºC ~ 60 ºC operating ambient temperature should guarantee function work.

### ELECTRICAL ABSOLUTE RATINGS

#### TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Power Supply Voltage | VDD | -0.3 | 4.0 | V | |



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**BACKLIGHT UNIT**

| Item | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Type. | Max | | |
| LED Voltage | $V_L$ | - | 17.15 | - | $V_{RMS}$ | |
| LED Current | $I_L$ | 828.4 | 872 | 915.6 | $mA_{RMS}$ | |
| LED Working Frequency | $F_L$ | 120 | 125 | 130 | KHz | |

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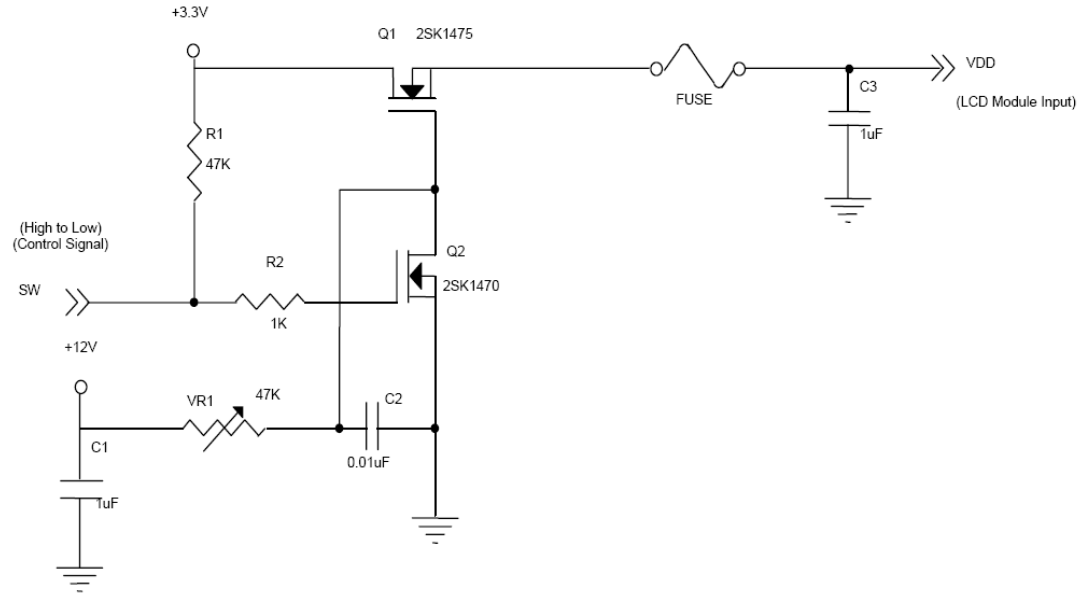
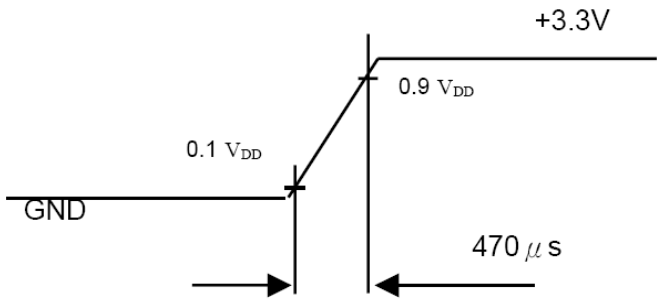
## ELECTRICAL CHARACTERISTICS

### TFT LCD MODULE

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min | Type | Max | | |
| Power Supply Voltage | | $V_{DD}$ | 3.0 | 3.3 | 3.6 | V | - |
| Ripple Voltage | | $V_{RP}$ | - | - | 100 | mVp-p | |
| Rush Current | | $I_{RUSH}$ | - | - | 2.0 | A | (2) |
| Power Supply Current | White | Icc | - | 500 | | mA | (3)a |
| | Black | | - | 750 | | mA | (3)b |
| Differential Input Voltage for LVDS Receiver Threshold | "H" Level | $V_{IH}$ | - | - | 100 | mV | - |
| | "L" Level | $V_{IL}$ | -100 | - | - | mV | - |
| Terminating Resistor | | $R_T$ | | 100 | - | Ohm | - |

Note (1) The module should be always operated within above ranges.
Note (2) Measurement Conditions:



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Note (3) The specified power supply current is under the conditions at $V_{DD}$ =3.3V, Ta = 25 ± 2 ºC, DC
Current and $f_v$ = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern

Active Area

**BACKLIGHT UNIT** Ta = 25 ± 2 ºC

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min | Type | Max | | |
| Power Consumption | $P_L$ | - | 14.95 | - | W | $I_L$=872 |
| LED Life Time | $L_{BL}$ | 70000 | | | Hrs | |

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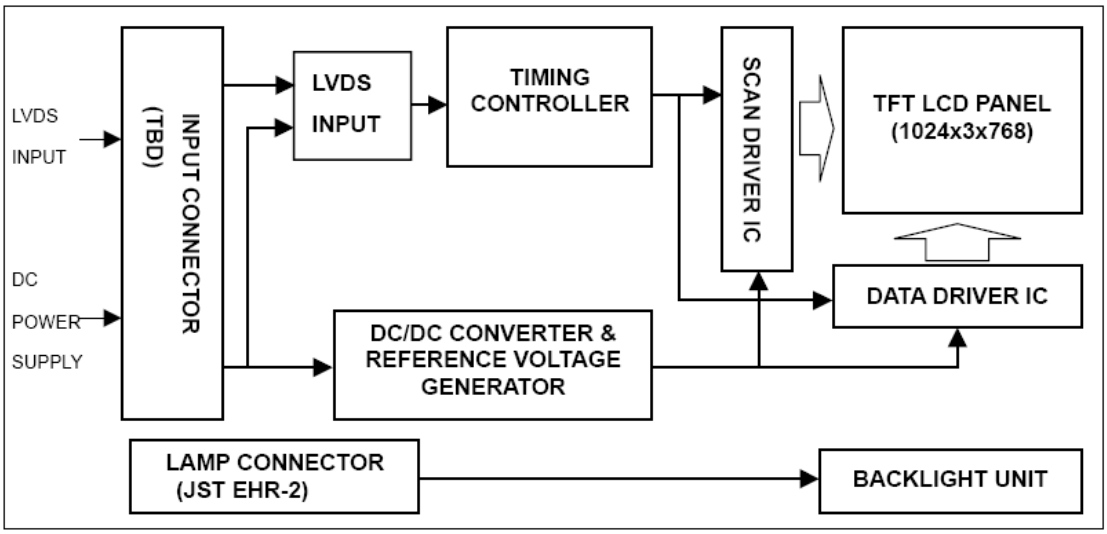
## BLOCK DIAGRAM

### TFT LCD MODULE

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## INPUT TERMINAL PIN ASSIGNMENT

### TFT LCD MODULE

| Pin No. | Symbol | Function | Polarity | Note |
|---|---|---|---|---|
| 1 | VDD | Power Supply +3.3V(typical) | | |
| 2 | VDD | Power Supply +3.3V(typical) | | |
| 3 | GND | Ground | | |
| 4 | GND | Ground | | |
| 5 | RX0- | LVDS Differential Data Input | Negative | |
| 6 | RX0+ | LVDS Differential Data Input | Positive | |
| 7 | GND | Ground | | |
| 8 | RX1- | LVDS Differential Data Input | Negative | |
| 9 | RX1+ | LVDS Differential Data Input | Positive | |
| 10 | GND | Ground | | |
| 11 | RX2- | LVDS Differential Data Input | Negative | |
| 12 | RX2+ | LVDS Differential Data Input | Positive | |
| 13 | GND | Ground | | |
| 14 | RXCLK- | LVDS Differential Data Input | Negative | |
| 15 | RXCLK+ | LVDS Differential Data Input | Positive | |
| 16 | GND | Ground | | |
| 17 | RX3- | LVDS Differential Data Input | Negative | |
| 18 | RX3+ | LVDS Differential Data Input | Positive | |
| 19 | GND | Ground | | |
| 20 | NC | tied to ground | | |

(1)Connector Part No.: [Hirose] DF14H-20P-1.25H
(2)Matching socket Part No.: [Hirose] DF14-20S-1.25C

### BACKLIGHT UNIT

| Pin | Symbol | Description | Color |
|---|---|---|---|
| 1 | Vcc | High Voltage | Red |
| 2 | GND | Ground | Black |

Note (1) Connector Part No.: HD2505-02 or equivalent
Note (2) Matching Connector Part No.: TD2505-02 or equivalent

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## COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

| Color | | Data Signal | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Red | | | | | | | | Green | | | | | | | | Blue | | | | | | | |
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | R7 | R6 | G5 | G4 | G3 | G2 | G1 | G0 | R7 | R6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale Of Red | Red(0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(2) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(252) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(252) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(252) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Green | Green(0)/Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(252) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(252) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(252) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Blue | Blue(0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(252) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(252) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(252) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

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## INTERFACE TIMING

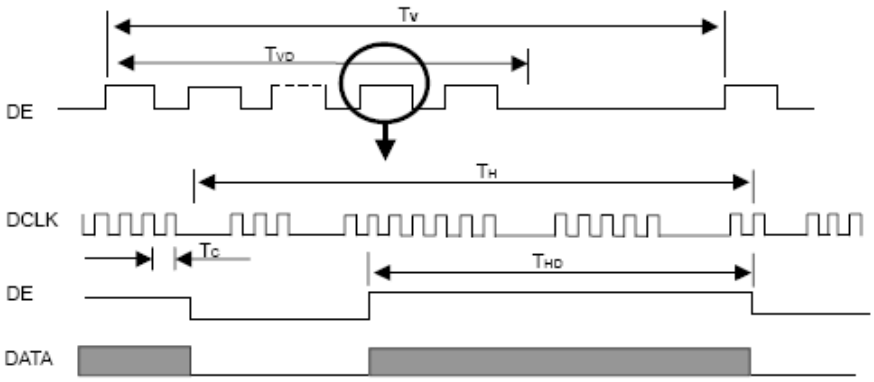
### INPUT SIGNAL TIMING SPECIFICATIONS

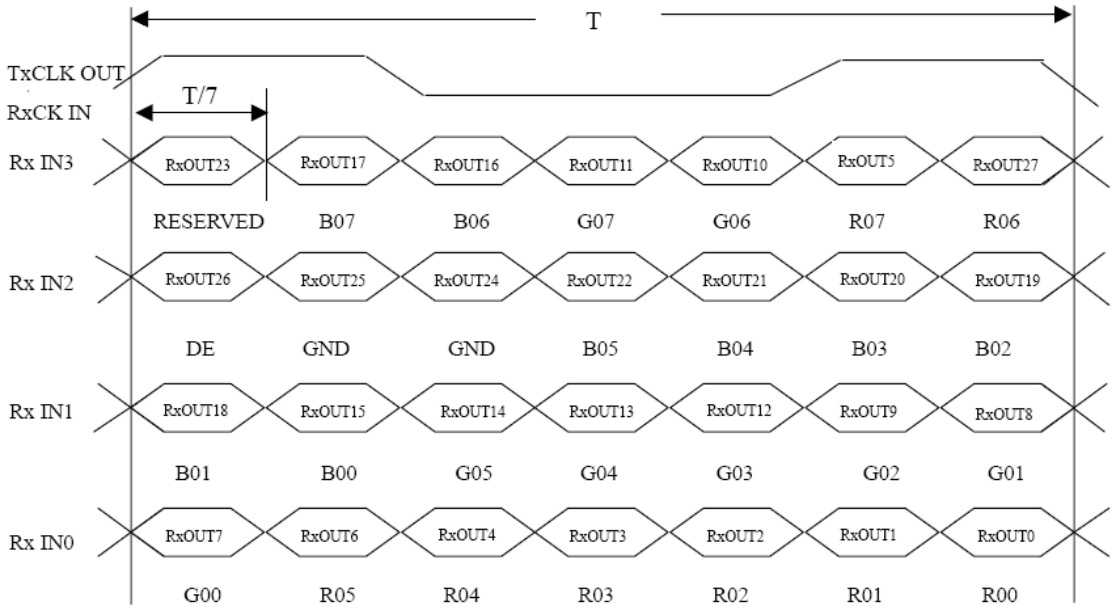
The input signal timing specifications are shown as the following table and timing diagram.

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| DCLK | Pixel Clock | 1/Tc | - | 65 | 80 | MHz | - |
| DE | Vertical Total Time | Tv | 780 | 806 | 1200 | TH | - |
| | Vertical Address Time | TVD | 768 | 768 | 768 | TH | - |
| | Horizontal Total Time | TH | 140 | 1344 | 1600 | Tc | - |
| | Horizontal Address Time | THD | 024 | 1024 | 1024 | Tc | - |

Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



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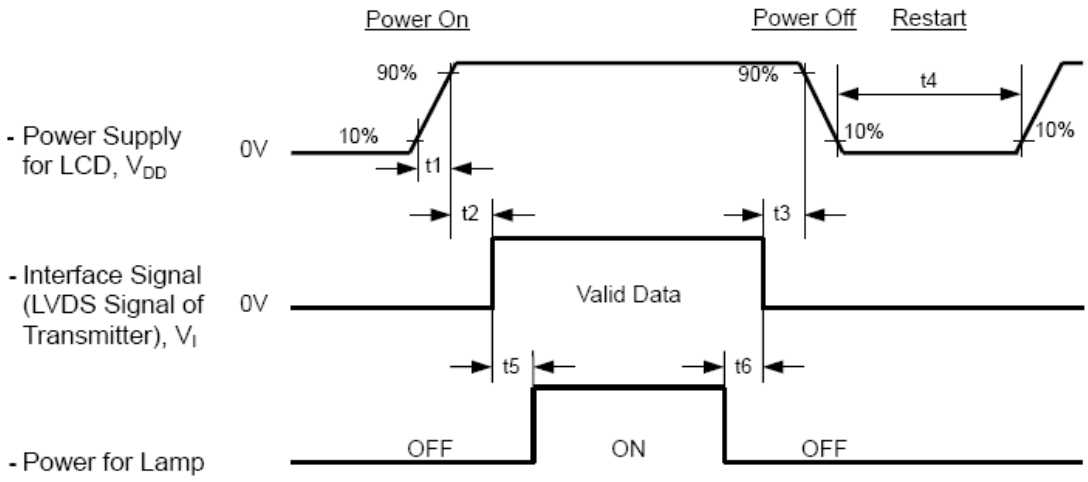
**POWER ON/OFF SEQUENCE**




Timing Specifications:

0.5 < t1 ≦ 10 msec

0 < t2 ≦ 50 msec

0 < t3 ≦ 50 msec

t4 ≧ 500 msec

t5 ≧ 200 msec

t6 ≧ 200 msec

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD $V_{DD}$ to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the l ogic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

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## OPTICAL CHARACTERISTICS

### TEST CONDITIONS

| Item | Symbol | Value | Unit |
|---|---|---|---|
| Ambient Temperature | Ta | 25±2 | °C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | $V_{DD}$ | 3.3 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| LED Current | $I_L$ | 872 | mA |
| LED Working Frequency | $F_L$ | 120 | KHz |
| LED Driver Board | Litemax LID15A02 | | |

### OPTICAL SPECIFICATIONS

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color Chromaticity | Red | Rx | θx=0°,θy=0° CS-1000T | Typ-0.03 | 0.603 | Typ+0.03 | | (1),(6) |
| | | Ry | | | 0.371 | | | |
| | Green | Gx | | | 0.375 | | | |
| | | Gy | | | 0.541 | | | |
| | Blue | Bx | | | 0.165 | | | |
| | | By | | | 0.084 | | | |
| | White | Wx | | | 0.341 | | | |
| | | Wy | | | 0.329 | | | |
| Center Luminance of White | | Lc | | | 1000 | | cd/㎡ | (4),(6) |
| Contrast Ratio | | CR | | 480 | 700 | | - | (2),(6) |
| Response Time | | $T_R$ | θx=0°,θy=0° | - | 8 | 13 | ms | (3) |
| | | $T_F$ | | - | 17 | 22 | | |
| White Variation | | δW | θx=0°,θy=0° | - | 1.25 | 1.4 | - | (6),(7) |
| Cross Talk | | CT | BM-5A | - | - | 5.0 | % | (5),(6) |
| Viewing Angle | Horizontal | θx+ | CR≧10 BM-5A | 70 | 80 | | Deg. | (1),(6),(8) |
| | | θx- | | 70 | 80 | | | |
| | Vertical | θy+ | | 70 | 80 | | | |
| | | θy- | | 70 | 80 | | | |

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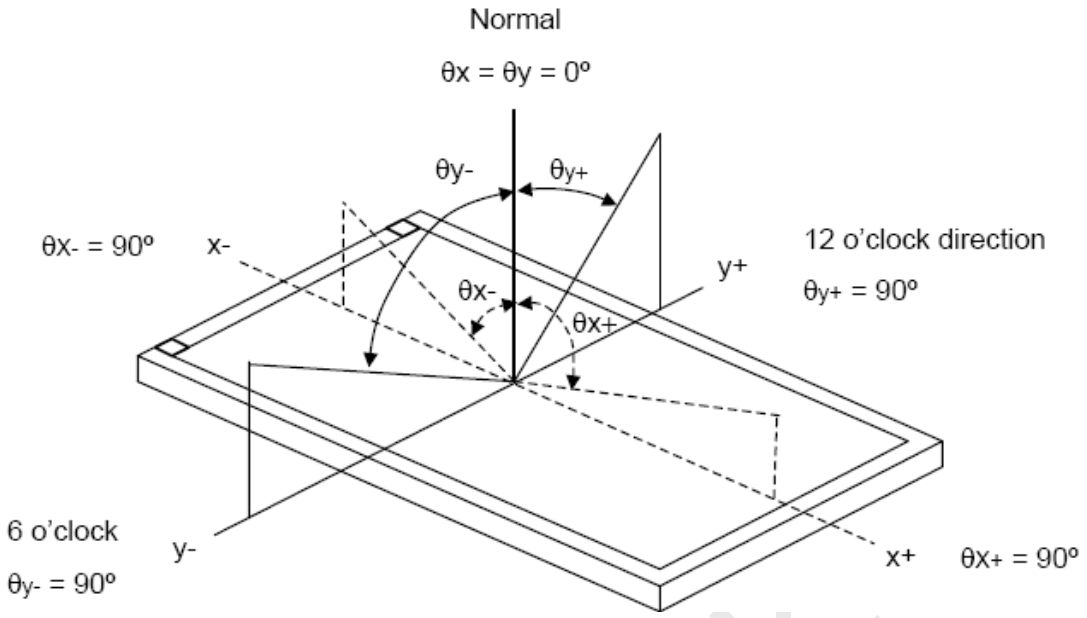
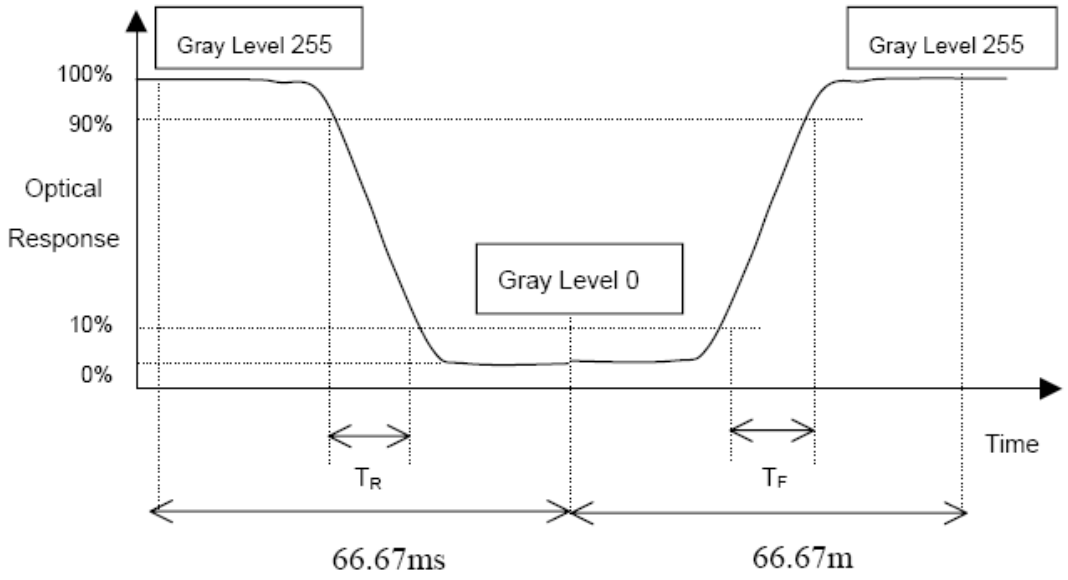
Note (1) Definition of Viewing Angle ( $\theta$ x, $\theta$ y):




Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.
Contrast Ratio (CR) = L255 / L0
L255: Luminance of gray level 255
L 0: Luminance of gray level 0
CR = CR (1)
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

Note (3) Definition of Response Time ($T_R$, $T_F$):



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Note (4) Definition of Luminance of White ($L_C$):

Measure the luminance of gray level 255 at center point

$L_C = L (5)$

L (x) is corresponding to the luminance of the point X at Figure in Note (7).

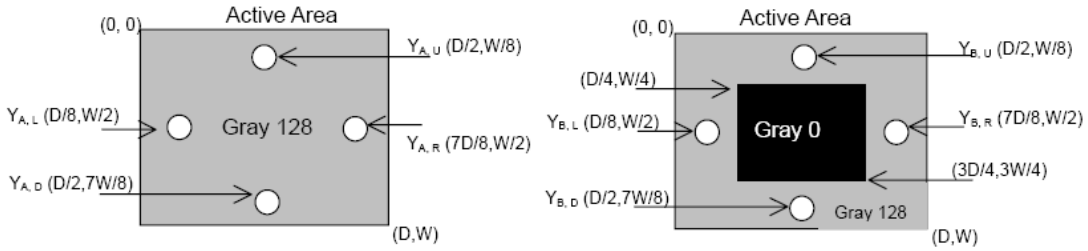
Note (5) Definition of Cross Talk (CT):

$CT = | Y_B – Y_A | / Y_A \times 100 (\%)$

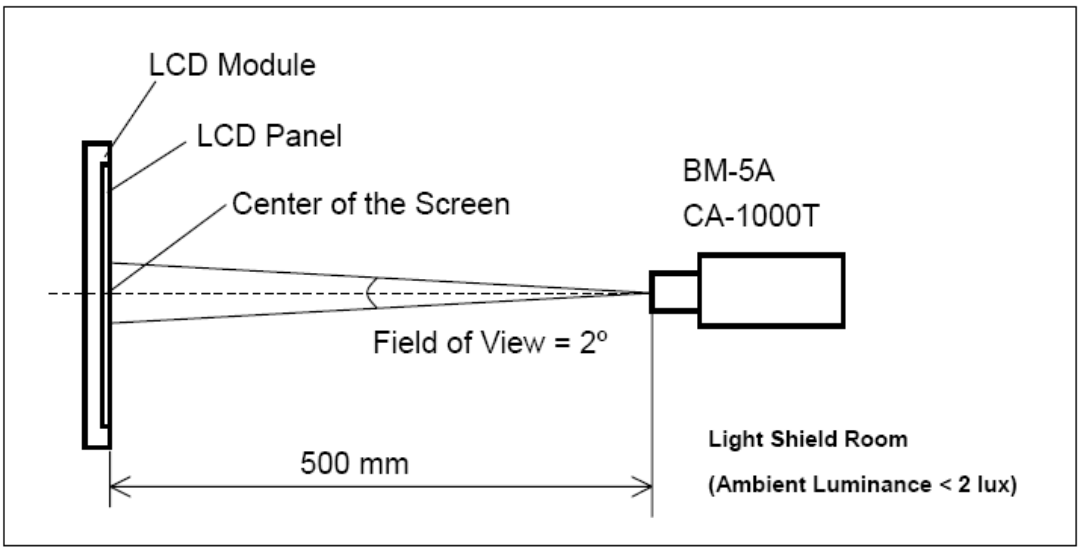
Where:

$Y_A$ = Luminance of measured location without gray level 0 pattern ($cd/m^2$)

$Y_B$ = Luminance of measured location with gray level 0 pattern ($cd/m^2$)




Note (6) Measurement Setup: The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



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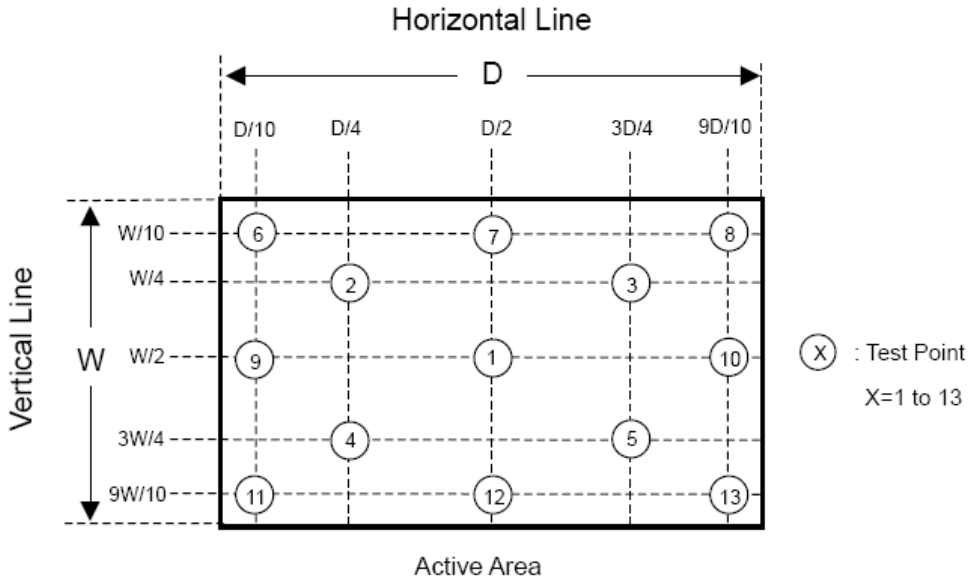
Note (7) Definition of luminance measured points: Measure the luminance of gray level 255 at point L(1) Definition of White Variation ( $\delta$ W): Measure the luminance of gray level 255 at 9 points

$$\delta W = \frac{\text{Maximum [L (1), L (6), L (7), L (8), L (9), L (10), L (11), L (12), L (13)]}}{\text{Minimum [L (1), L (6), L (7), L (8), L (9), L (10), L (11), L (12), L (13)]}}$$




Note (8) TN type has Gray scale inversion occurs at $\theta_y$: -40°



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## PRECAUTIONS

### HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
(9) Do not disassemble the module.
(10) Do not pull or fold the lamp wire.
(11) Pins of I/F connector should not be touched directly with bare hands.

### STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

### OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.
(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

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